named in the various curricula suggested by educational associations. The topics considered valuable but not essential are placed in an appendix. More than this, the authors have sought, by means of the practical problems, to give proper preparation to those who are fitting themselves for a trade. The noteworthy features of the book are the early and simple introduction of graphs with a table of squares and cubes at the end of the book to facilitate computation, the large number of oral problems under each topic and the cumulative reviews at the end of the book. There is also a very brief history of Algebra.

R. R. SHUMWAY.

Higher Algebra. By HERBERT E. HAWKES. Ginn and Company, Boston, 1913. vi + 222 pages. $1.25.

This algebra is an admirable rearrangement and revision of selected chapters from the *Advanced Algebra* published by the same author eight years ago. Pedagogically and typographically the book marks a distinct advance over the earlier work.

As a relatively large number of texts are upon the market dealing with high-school algebra and as more bid fair to appear, it would be highly desirable for the publishers to agree upon a somewhat precise definition of the terms, higher algebra, advanced algebra, college algebra, elementary algebra, and algebra. Our terminology, unfortunately somewhat fixed, seems distinctly inferior to that employed in Europe. A foreign mathematician who chances upon an American "higher algebra" with the content of this one would doubtless be led to inquire into the nature of our "lower algebra." On the other hand, the appearance of our books is decidedly superior, though even this is not an unmixed blessing, for the complete explanations accompanied by numerous diagrams bear mute witness to the fact that many high school teachers require all this paraphernalia to present the subject. Even with the best teachers such complete texts as our American publishers and authors are presenting have their disadvantages, for the pupil is encouraged to believe that the teacher's explanation is of secondary importance. A desirable innovation for test purposes would be a text-book on algebra consisting only of a few formulas, possibly those commonly put in heavy type, together with long sets of exercises. Pupils would be compelled to attend closely to class demonstrations and the teacher would become something more than a commentator.

Eleven chapters are included in this work together with four-place logarithms and tables for the extraction of square and cube roots. The chapter headings are as follows: Introductory review, functions and their graphs, quadratic equations, inequalities, complex numbers, theory of equations, permutations, combinations, and probability, determinants, partial fractions, logarithms, infinite series.

Only minor points would seem to require criticism. The paragraph, page 48, on the "reduced form" $x^2 + px + q = 0$ of the quadratic $ax^2 + bx + c = 0$ seems unnecessary and undesirable. Furthermore, "reduce" is twice used in the introductory discussion of this passage in a different sense from that of the

caption. The omission of any discussion of even the simplest types of simultaneous quadratics is unfortunate in a text explicitly designed for "the student who will continue his mathematics as far as the calculus." In analytic geometry simultaneous quadratics occur as frequently as any topic of algebra. The extension of Horner's method to the computation of larger roots by approximating first to hundreds, then tens, then units, is desirable. No hint of this is given in the text nor is any problem presented which suggests this extension.

Only one historical note is found in the text and that involves a disputed point. Tartaglia arrived at the solution of the cubic before Cardan, as the latter stated in his published work. However Scipio Ferro (died 1526), also cited by Cardan, was prior to both in the solution of the cubic of the form, $x^3 + ax = b$.

L. C. KARPINSKI.

PROBLEMS AND QUESTIONS.

B. F. FINKEL, CHAIRMAN OF THE COMMITTEE.

PROBLEMS FOR SOLUTION.

ALGEBRA.

388. Proposed by JOSEPH V. COLLINS, Stevens Point, Wis.

On a certain typewriter there is a double scale as follows:

80........70........60........50........40........30........20........10........ 0
1 .... 5........10........15........20........25........30........35........40

It is used to locate headings in the middle of the page. To space a heading one sets the machine at the right stop and with the spacer counts out the number of letters and spaces in the heading. To the reading on the 40 scale where the carriage stops is added the reading of the right stop on the same scale. This number is the one on which to set the carriage pointer on the 80 scale to begin the heading. Show by algebra that the method is correct.

389. Proposed by W. W. BEMAN, Univ. of Michigan.

If $e^{e^x} = 1 + a_1x + a_2x^2 + a_3x^3 \cdots$, prove that

$$na_n = \Sigma_{k=1}^{k=n} \frac{1}{(k-1)!} a_{n-k}, \qquad \text{or} \qquad n!\,a_n = \Sigma_{k=1}^{k=n} \frac{(n-1)!}{(k-1)!} a_{n-k},$$

which latter form lends itself more readily to computation.

390. Proposed by E. B. ESCOTT, University of Michigan.

Sum the series,

$$\tfrac{1}{1} + \tfrac{1}{2} + \tfrac{2}{4} + \tfrac{3}{8} + \tfrac{5}{16} + \tfrac{8}{32} + \cdots,$$

where each numerator is the sum of the two preceding and the denominators are in geometrical progression.

391. Proposed by C. N. SCHMALL, New York, N. Y.

Show that the roots of the quadratic

$$ax^2 + 2bx + c = 0$$

are imaginary if a, b, c, are in harmonic progression and have the same sign.

GEOMETRY.

417. Proposed by R. P. BAKER, University of Iowa.

Enumerate the points in which the twelve dihedral bisector planes of a tetrahedron meet, find their multiplicity and account for the 220 points which 12 planes in general determine.